OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.055 (Project)	DATE May 14, 1968

Change 1 — 3C

APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 3C

TO : Distribution

FROM: Harold T. Fuselier
DIRECTOR, APOLLO APPLICATIONS

SUBJECT: Change 1 to Apollo Applications Program Directive No. 3C

The attached changes are to be incorporated into the subject directive on a page-for-page substitution basis. This memorandum should be attached to the basic document for future reference. Substance of the changes is as follows:

a. Time period for Saturn I Workshop reactivation and reuse has been changed to 8 months.

b. Requirement for Saturn I Workshop hardware to interface with AAP-5, 6 and 7 revisit missions has been eliminated.

c. Experiment assignment list has been updated.

d. Provision has been made for execution of primary medical experiments in the MDA.

Changes are underlined to facilitate identification.

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Attachments
(Pages 2, 3, 4, 6, 7 & 8)

b. Provide for reactivation and reuse of the Saturn I Workshop during subsequent missions occurring up to 8 months later.

c. Conduct in-flight experiments in the areas of science, applications, technology, engineering and medicine.

d. Qualify man, evaluate his support requirements and determine human task performance capability on long duration manned space flight missions.

2.0 MISSION OBJECTIVES

2.1 Primary Objectives: The primary objectives of Mission AAP-1/AAP-2 are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Demonstrate rendezvous and hard dock of the CSM to the Multiple Docking Adapter.

b. Determine the feasibility of operating the Saturn I Workshop (Experiment M402 and elements of M487) as a habitable space structure for a period of up to 28 days from the AAP-1 launch date through evaluation of CSM/S-IVB/Airlock/Multiple Docking Adapter to include the following:

(1) Subsystems performance.
(2) Astronaut mobility and work capability in both intra- and extra-vehicular activity.

c. Obtain data to evaluate space flight environmental effects on the crew of a mission duration up to 28 days (Experiments M050, M051, M052).

2.2 Secondary Objectives: The secondary objectives of Mission AAP-1/AAP-2 are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules. Experiment assignments are tentative as explained in Section 5 below.

a. Demonstrate the feasibility of extending CSM mission duration through incorporation of additional expendables in the Service Module.

b. Leave the Saturn I Workshop in orbit for reactivation and reuse up to 8 months later.

c. Verify the ability of mission ground support systems to support mission activities of extended duration.

d. Obtain engineering and technological data needed for development of advanced space vehicles and equipment (Experiments M415, M479, M487, M489, M492, M493, M508, M509, D008, D017, D019, D020, D021, D022, T013, T017, T018, T020, T021, T023, T025, T027).

e. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (Experiment S065).

f. Obtain data to develop a more complete understanding of the physical characteristics of the extra-atmospheric environment (Experiments S009, S018).

g. Obtain medical and biological data as required for evaluation of the effects of weightlessness on man (Experiments M018, M053, M055, M056, M058, S015, T004).

h. Obtain stellar and solar astronomy data (Experiments S019, S020).

3.0 GENERAL FLIGHT PLAN

3.1 Launch Vehicle Powered Flights:

a. AAP-1 is a manned flight involving a Saturn IB launch vehicle and a modified Block II CSM. It will be launched after AAP-2 from LC 34 at KSC into an 81 x 120 n. mi. orbit at a time and azimuth to facilitate rendezvous with the AAP-2 Saturn I Workshop.

b. AAP-2 is an unmanned flight involving a Saturn IB launch vehicle, an Airlock, a Multiple Docking Adapter and a nose cone. It will precede AAP-1 and will be launched from LC 37B at KSC into a 230 n. mi. circular orbit having a nominal inclination of 28.9°.

3.2 Spacecraft Flight Profile: The launch timing and orbital inclination of the AAP-1 spacecraft will be selected to permit expeditious rendezvous with the AAP-2 Saturn I Workshop. After injection into orbit, the CSM will separate from the SLA and will make the requisite transitional maneuvers to rendezvous with the Saturn I Workshop. The CSM will dock to the axial port of the Multiple Docking Adapter and the Saturn I Workshop will be activated for habitation. The remainder of the 28-day mission will be devoted to the conduct of experiments and evaluation of the Saturn I Workshop systems. The CM will then return to earth leaving the Saturn I Workshop inactive in earth orbit.

3.3 Interface with Future AAP Missions: Since the plan for execution of primary mission objectives of subsequent missions will be constrained by the operational capability of the hardware placed in orbit by AAP-1/AAP-2, it is imperative that the following requirements be considered concomitantly with the AAP-2 S-IVB stage modifications and the Airlock/Multiple Docking Adapter design:

a. Revisitation and reactivation of the EPS and ECS for a period of up to 56 days for each of the following revisits:

   (1) AAP-3A
   (2) AAP-3/AAP-4

b. Incorporation of systems status monitoring equipment for ground interrogation during inactive orbital storage.

c. Radial docking of an unmanned Lunar Module (ascent stage)/Apollo Telescope Mount (LM/ATM). Contingency transfer of electrical power between LM/ATM and the Airlock.

d. Accommodation of ancillary hardware for conduct of additional experiments carried on later missions.

e. Stabilization during docking operations for revisit missions and the possible exercise of intermittent attitude control during orbital storage periods.

4.3 Airlock/Multiple Docking Adapter: The Airlock/Multiple Docking Adapter will:

a. Provide access to the S-IVB after it is in orbit.

b. Provide the two-gas actuation control system required to pressurize the Saturn I Workshop and an environmental conditioning system for itself and the Saturn I Workshop.

c. Provide a power distribution system to receive power supplied by the CSM fuel cells and the S-IVB solar arrays and to distribute power as required by the S-IVB, MDA, Airlock and experiments.

d. Provide for contingency power distribution to the LM/ATM (AAP-3/AAP-4) when it is hard docked to the MDA.

e. Provide for experiment support for both the AAP-1 and AAP-2 flights as well as that required for execution of AAP-3A and AAP-3/AAP-4.

f. Carry instrumentation for operational evaluation of the Airlock/Saturn I Workshop as a habitable space structure.

g. Provide for storage in the MDA of all experiments designated for transport therein during powered flight.

h. Provide for execution in the MDA of all primary objective medical experiments (M050, M051, M052) together with essential support hardware. Requirements for execution of selected secondary objective medical experiments in the MDA are under study.

i. Provide backup workspace in the MDA for contingency execution (Workshop inaccessible) of essential elements of M487 and those secondary experiments which can be accommodated without requiring MDA system and experiment design changes for contingency operation.

j. Provide required radial docking port(s) and an inline port. The radial port(s) will permit docking to the MDA of a LM/ATM. The inline port will provide for docking of a CSM.

k. Provide sufficient in-orbit monitoring and command capability for the storage period to determine equipment status.

4.4 Spacecraft: The AAP-1 CSM will be a standard Block II Apollo configuration modified to:

a. Provide electrical power to the Airlock.

b. Carry and support experiment hardware as required.

c. Provide a low pressure GOX internal umbilical to the Airlock EVA system.

d. Provide for use of the RCS system as a backup retrofire system.

e. Provide expanded SM-RCS propellant capabilities to support the AAP-1/ AAP-2 Mission.

f. Carry O_2, N_2 and H_2 consumables to extend the AAP-1/AAP-2 Mission to 28 days.

g. Provide a two-gas atmosphere pressure regulation system for the AL/ MDA/Saturn I Workshop activation and operation for a 28-day mission.

4.5 SLA: The SLA for AAP-2 will be modified as necessary to accommodate launch of the Airlock/MDA and to provide for jettison of the SLA panels during powered flight.

5.0 EXPERIMENTS

The following experiments are assigned to the AAP-1/AAP-2 Mission. They are listed in relative order of priority by flight, subject to MSFEB approval.

5.1 AAP-1:

Objective	Exp. No.	Title	Dev. Center	Launch Location
Primary	M052	Bone and Muscle Changes	MSC	CM
Secondary	M056	Non-Gravimetric Mass Measurement	MSC	CM
Secondary	S015	Zero-G Single Human Cell	MSC	CM
Secondary	S027	Galactic X-ray Mapping	MSFC	IU
Secondary	M415	Thermal Control Coatings	MSFC	IU/EXT
Secondary	T018	Precision Optical Tracking	MSFC	IU/EXT
Secondary	D008	Radiation in Spacecraft	AF/MSC	CM

5.2 AAP-2:

Primary	M402	Orbital Workshop	MSFC	S-IVB
Secondary*	M487	Habitability/Crew Quarters	MSFC	S-IVB/MDA
Primary	M051	Cardiovascular Function Assessment	MSC	MDA
Primary	M050	Metabolic Activity	MSC	MDA
Primary	M052	Bone and Muscle Changes	MSC	MDA
Secondary	M056	Non-Gravimetric Mass Measurement	MSC	MDA
Secondary	M058	Human Mass Measurement Device	MSC	MDA
Secondary	M053	Human Vestibular Function	MSC	MDA
Secondary	M018	Vectorcardiogram	MSC	MDA
Secondary	M055	Time and Motion Study	MSC	MDA

*Elements of this experiment vital to accomplishment of the 28-day mission are to be considered primary objectives.

Objective	Exp. No.	Title	Dev. Center	Launch Location
Secondary	D019	Suit Donning and Sleep Station Evaluation	AF/MSFC	MDA/OWS
Secondary	D020	Alternate Restraints Evaluation	AF/MSFC	MDA
Secondary	T025	Coronograph Contamination Measurement	MSC	MDA
Secondary	S018	Micrometeorite Collection	MSC	MDA
Secondary	T027	ATM Contamination Measurement	MSFC	MDA
Secondary	M509	Astronaut Maneuvering Equipment	MSC	MDA
Secondary	M508	EVA Hardware Evaluation	MSC	MDA
Secondary	T020	Jet Shoes	LaRC	MDA
Secondary	D021	Expandable Airlock Technology	AF/MSC	AM/EXT
Secondary	S065	Multiband Terrain Photography (Hand Held)	MSC	MDA
Secondary	T003	In-flight Nephelometer	MSC	MDA
Secondary	M479	Zero-G Flammability	MSC	MDA
Secondary	T013	Crew Vehicle Disturbance	LaRC	MDA
Secondary	T018	Precision Optical Tracking	MSFC	IU/EXT
Secondary	S009	Nuclear Emulsion	MSC	MDA
Secondary	T004	Frog Otolith Function	MSC	AM/EXT
Secondary	T023	Surface Adsorbed Materials	MSFC	S-IVB
Secondary	T021	Meteoroid Velocity	MSC	AM/EXT
Secondary	T017	Meteoroid Impact and Erosion	MSC	AM/EXT
Secondary	D022	Expandable Structures for Recovery	AF/MSC	AM/EXT
Secondary	D017	Carbon Dioxide Reduction	AF/MSC	AM/EXT
Secondary	S019	UV Stellar Astronomy	MSC	MDA
Secondary	S020	UV/X-ray Solar Photography	MSC	MDA
Secondary	M489	Heat Exchanger Service	MSC	MDA
Secondary	M493	Electron Beam Welding	MSFC	MDA
Secondary	M492	Tube Joining Assemblies	MSFC	MDA

5.3 Implementation: The following instructions are established for development, payload integration and mission planning activities associated with the above experiments:

a. Develop, integrate and include in operational mission planning all experiments assigned to AAP-1.

b. Develop all experiments assigned to AAP-2 within funding constraints.

c. The current objective is to integrate and operate as many of the experiments in AAP-2 as possible. Therefore, time line requirements and experiment support requirements (power, space, weight, cooling, etc.) will be reassessed and revised through a compatibility analysis to maximize the number of experiments that can be conducted. The relative priorities identified above are to be considered in this

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DO/Ross
AD/VanStaden
AA/Morgan
AA-ADV/Hock
AA-SVO/Raffaelli (60)
LO/Petrone
AP/Middleton
EX/Murphy
TS/Clark
DE/Preston
IS/Miller
SO-PLN/Manton

MSC
AA/Gilruth
AB/Deputy Director
AD/West
KA/Thompson (85)
PA/Low (5)
PA/Rees
EA/Faget
TA/Hess (5)
ET/Stoney
FA/Kraft (2)
FA4/Fielder
FC/Hodge (8)
FM/Mayer (2)
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IS-CAS-42

OFFICE OF MANNED SPACE FLIGHT

APOLLO APPLICATIONS PROGRAM

PROGRAM DIRECTIVE NO. 3C

1968

FLIGHT MISSION DIRECTIVE FOR AAP-1/AAP-2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON 25, D. C.

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D ML 3200.055 (Project)	DATE January 31, 1968

APOLLO APPLICATIONS
PROGRAM DIRECTIVE NO. 3C

TO : Distribution

FROM: Charles W. Mathews
DIRECTOR, APOLLO APPLICATIONS

SUBJECT: Flight Mission Directive for Mission AAP-1/AAP-2

REF : (a) Apollo Applications Flight Mission Assignments Directive, M-D ML 3200.056, dated January 1967
(b) Apollo Applications Planning Schedule, ML-13A, dated January 5, 1968
(c) Apollo Flight Mission Assignments Directive, M-D MA 500-11, dated November 1966
(d) Apollo Applications Test Requirements Document, NHB 8080.3, dated October 13, 1967
(e) Apollo Program Directive No. 6A dated August 30, 1966
(f) Apollo Program Directive No. 15 dated January 25, 1966
(g) Reliability and Quality Assurance Plan, NHB 5300.5, dated May 1967

PURPOSE: This directive defines AAP requirements and responsibilities to initiate those actions prerequisite to execution of the AAP-1/AAP-2 Mission authorized in reference (a). The mission is scheduled for launch as indicated in reference (b) in the event that the launch vehicles and spacecraft assigned to the Apollo-Saturn missions, reference (c), are not required to support the mainline Apollo Program. This directive supersedes Apollo Applications Program Directive No. 3B dated June 19, 1967, and Change 1 dated September 22, 1967.

1.0 MISSION PURPOSE

The purposes of the AAP-1/AAP-2 Mission are as follows:

a. Conduct a low altitude, low inclination earth orbital mission with a crew of three men, open ended to 28 days duration using a spent S-IVB stage as an Orbital Workshop.

b. Provide for reactivation and reuse of the Saturn I Workshop during subsequent missions occurring up to 8 months later.

c. Conduct in-flight experiments in the areas of science, applications, technology, engineering and medicine.

d. Qualify man, evaluate his support requirements and determine human task performance capability on long duration manned space flight missions.

2.0 MISSION OBJECTIVES

2.1 Primary Objectives: The primary objectives of Mission AAP-1/AAP-2 are listed below. They may be amplified but not modified by the centers. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

a. Demonstrate rendezvous and hard dock of the CSM to the Multiple Docking Adapter.

b. Determine the feasibility of operating the Saturn I Workshop (Experiment M402 and elements of M487) as a habitable space structure for a period of up to 28 days from the AAP-1 launch date through evaluation of CSM/S-IVB/Airlock/Multiple Docking Adapter to include the following:

(1) Subsystems performance.
(2) Astronaut mobility and work capability in both intra- and extra-vehicular activity.

c. Obtain data to evaluate space flight environmental effects on the crew of a mission duration up to 28 days (Experiments M050, M051, M052).

2.2 Secondary Objectives: The secondary objectives of Mission AAP-1/AAP-2 are summarized below. Preflight malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to meet these objectives may be cause to hold or cancel the mission as specified in the Mission Rules. Experiment assignments are tentative as explained in Section 5 below.

a. Demonstrate the feasibility of extending CSM mission duration through incorporation of additional expendables in the Service Module.

b. Leave the Saturn I Workshop in orbit for reactivation and reuse up to 8 months later.

c. Verify the ability of mission ground support systems to support mission activities of extended duration.

d. Obtain engineering and technological data needed for development of advanced space vehicles and equipment (Experiments M415, M479, M487, M489, M492, M493, M508, M509, D008, D017, D019, D020, D021, D022, T013, T017, T018, T020, T021, T023, T025, T027).

e. Obtain data prerequisite to identification of earth resources and development of improved cartographic procedures (Experiment S065).

f. Obtain data to develop a more complete understanding of the physical characteristics of the extra-atmospheric environment (Experiments S009, S018).

g. Obtain medical and biological data as required for evaluation of the effects of weightlessness on man (Experiments M018, M053, M055, M056, M058, S015, T004).

h. Obtain stellar and solar astronomy data (Experiments S019, S020).

3.0 GENERAL FLIGHT PLAN

3.1 Launch Vehicle Powered Flights:

a. AAP-1 is a manned flight involving a Saturn IB launch vehicle and a modified Block II CSM. It will be launched after AAP-2 from LC 34 at KSC into an 81 x 120 n. mi. orbit at a time and azimuth to facilitate rendezvous with the AAP-2 Saturn I Workshop.

b. AAP-2 is an unmanned flight involving a Saturn IB launch vehicle, an Airlock, a Multiple Docking Adapter and a nose cone. It will precede AAP-1 and will be launched from LC 37B at KSC into a 230 n. mi. circular orbit having a nominal inclination of 28.9°.

3.2 Spacecraft Flight Profile: The launch timing and orbital inclination of the AAP-1 spacecraft will be selected to permit expeditious rendezvous with the AAP-2 Saturn I Workshop. After injection into orbit, the CSM will separate from the SLA and will make the requisite transitional maneuvers to rendezvous with the Saturn I Workshop. The CSM will dock to the axial port of the Multiple Docking Adapter and the Saturn I Workshop will be activated for habitation. The remainder of the 28-day mission will be devoted to the conduct of experiments and evaluation of the Saturn I Workshop systems. The CM will then return to earth leaving the Saturn I Workshop inactive in earth orbit.

3.3 Interface with Future AAP Missions: Since the plan for execution of primary mission objectives of subsequent missions will be constrained by the operational capability of the hardware placed in orbit by AAP-1/AAP-2, it is imperative that the following requirements be considered concomitantly with the AAP-2 S-IVB stage modifications and the Airlock/Multiple Docking Adapter design:

a. Revisitation and reactivation of the EPS and ECS for a period of up to 56 days for each of the following revisits:

   (1) AAP-3A
   (2) AAP-3/AAP-4

b. Incorporation of systems status monitoring equipment for ground interrogation during inactive orbital storage.

c. Radial docking of an unmanned Lunar Module (ascent stage)/Apollo Telescope Mount (LM/ATM). Contingency transfer of electrical power between LM/ATM and the Airlock.

d. Accommodation of ancillary hardware for conduct of additional experiments carried on later missions.

e. Stabilization during docking operations for revisit missions and the possible exercise of intermittent attitude control during orbital storage periods.

3.4 Recovery: Water recovery to be developed for the CM consistent with the above-stated profile characteristics and the normal recovery constraints associated with the deployment of recovery forces and the local lighting conditions at the time of recovery.

3.5 Mission Support Requirements: These requirements will be supplied in a "Program Support Requirements" document to be issued by the Operations Support Office, Mission Operations, OMSF, not later than four months prior to launch.

4.0 CONFIGURATION

4.1 Launch Vehicles: Uprated Saturn I launch vehicles as assigned by references (a) and (b) will be used for the AAP-1 and AAP-2 flights. With the exception of the AAP-2 S-IVB, modifications will be limited to the minimum necessary to achieve proper trajectory stabilization and control. The AAP-2 S-IVB will be modified to incorporate the following:

a. Orbital Workshop facilities:

(1) Propulsion system passivation.
(2) LH_2 tank conversion for habitation.
(3) Micrometeoroid bumper.
(4) Fire retardant liner.
(5) Ancillary hardware to support experiments designated for execution in the Orbital Workshop.

b. An articulated solar cell power system to supply electric power to the Airlock power distribution system after injection into orbit.

c. An auxiliary attitude control system (AACS) for S-IVB attitude control after injection into orbit. The AACS will provide for the following:

(1) Stabilization during rendezvous and docking operations.
(2) Attitude control for the AAP-1/AAP-2 and AAP-3A Missions durations.
(3) Intermittent attitude control during the orbital storage periods between missions.
(4) Stabilization during revisit, rendezvous and docking operations.

4.2 Nose Cone: A nose cone as designed for an unmanned Apollo LM launch will provide an aerodynamic shroud for AAP-2. It will be jettisoned during powered flight.

4.3 Airlock/Multiple Docking Adapter: The Airlock/Multiple Docking Adapter will:

a. Provide access to the S-IVB after it is in orbit.

b. Provide the two-gas actuation control system required to pressurize the Saturn I Workshop and an environmental conditioning system for itself and the Saturn I Workshop.

c. Provide a power distribution system to receive power supplied by the CSM fuel cells and the S-IVB solar arrays and to distribute power as required by the S-IVB, MDA, Airlock and experiments.

d. Provide for contingency power distribution to the LM/ATM (AAP-3/AAP-4) when it is hard docked to the MDA.

e. Provide for experiment support for both the AAP-1 and AAP-2 flights as well as that required for execution of AAP-3A and AAP-3/AAP-4.

f. Carry instrumentation for operational evaluation of the Airlock/Saturn I Workshop as a habitable space structure.

g. Provide for storage in the MDA of all experiments designated for transport therein during powered flight.

h. Provide for execution in the MDA of all primary objective medical experiments (M050, M051, M052) together with essential support hardware. Requirements for execution of selected secondary objective medical experiments in the MDA are under study.

i. Provide backup workspace in the MDA for contingency execution (Workshop inaccessible) of essential elements of M487 and those secondary experiments which can be accommodated without requiring MDA system and experiment design changes for contingency operation.

j. Provide required radial docking port(s) and an inline port. The radial port(s) will permit docking to the MDA of a LM/ATM. The inline port will provide for docking of a CSM.

k. Provide sufficient in-orbit monitoring and command capability for the storage period to determine equipment status.

4.4 Spacecraft: The AAP-1 CSM will be a standard Block II Apollo configuration modified to:

a. Provide electrical power to the Airlock.

b. Carry and support experiment hardware as required.

c. Provide a low pressure GOX internal umbilical to the Airlock EVA system.

d. Provide for use of the RCS system as a backup retrofire system.

e. Provide expanded SM-RCS propellant capabilities to support the AAP-1/AAP-2 Mission.

f. Carry O_2, N_2 and H_2 consumables to extend the AAP-1/AAP-2 Mission to 28 days.

g. Provide a two-gas atmosphere pressure regulation system for the AL/MDA/Saturn I Workshop activation and operation for a 28-day mission.

4.5 SLA: The SLA for AAP-2 will be modified as necessary to accommodate launch of the Airlock/MDA and to provide for jettison of the SLA panels during powered flight.

5.0 EXPERIMENTS

The following experiments are assigned to the AAP-1/AAP-2 Mission. They are listed in relative order of priority by flight, subject to MSFEB approval.

5.1 AAP-1:

Objective	Exp. No.	Title	Dev. Center	Launch Location
Primary	M052	Bone and Muscle Changes	MSC	CM
Secondary	M056	Non-Gravimetric Mass Measurement	MSC	CM
Secondary	S015	Zero-G Single Human Cell	MSC	CM
Secondary	S027	Galactic X-ray Mapping	MSFC	IU
Secondary	M415	Thermal Control Coatings	MSFC	IU/EXT
Secondary	T018	Precision Optical Tracking	MSFC	IU/EXT
Secondary	D008	Radiation in Spacecraft	AF/MSC	CM

5.2 AAP-2:

Primary	M402	Orbital Workshop	MSFC	S-IVB
Secondary*	M487	Habitability/Crew Quarters	MSFC	S-IVB/MDA
Primary	M051	Cardiovascular Function Assessment	MSC	MDA
Primary	M050	Metabolic Activity	MSC	MDA
Primary	M052	Bone and Muscle Changes	MSC	MDA
Secondary	M056	Non-Gravimetric Mass Measurement	MSC	MDA
Secondary	M058	Human Mass Measurement Device	MSC	MDA
Secondary	M053	Human Vestibular Function	MSC	MDA
Secondary	M018	Vectorcardiogram	MSC	MDA
Secondary	M055	Time and Motion Study	MSC	MDA

*Elements of this experiment vital to accomplishment of the 28-day mission are to be considered primary objectives.

Objective	Exp. No.	Title	Dev. Center	Launch Location
Secondary	D019	Suit Donning and Sleep Station Evaluation	AF/MSFC	MDA/OWS
Secondary	D020	Alternate Restraints Evaluation	AF/MSFC	MDA
Secondary	T025	Coronograph Contamination Measurement	MSC	MDA
Secondary	S018	Micrometeorite Collection	MSC	MDA
Secondary	T027	ATM Contamination Measurement	MSFC	MDA
Secondary	M509	Astronaut Maneuvering Equipment	MSC	MDA
Secondary	M508	EVA Hardware Evaluation	MSC	MDA
Secondary	T020	Jet Shoes	LaRC	MDA
Secondary	D021	Expandable Airlock Technology	AF/MSC	AM/EXT
Secondary	S065	Multiband Terrain Photography (Hand Held)	MSC	MDA
Secondary	T003	In-flight Nephelometer	MSC	MDA
Secondary	M479	Zero-G Flammability	MSC	MDA
Secondary	T013	Crew Vehicle Disturbance	LaRC	MDA
Secondary	T018	Precision Optical Tracking	MSFC	IU/EXT
Secondary	S009	Nuclear Emulsion	MSC	MDA
Secondary	T004	Frog Otolith Function	MSC	AM/EXT
Secondary	T023	Surface Adsorbed Materials	MSFC	S-IVB
Secondary	T021	Meteoroid Velocity	MSC	AM/EXT
Secondary	T017	Meteoroid Impact and Erosion	MSC	AM/EXT
Secondary	D022	Expandable Structures for Recovery	AF/MSC	AM/EXT
Secondary	D017	Carbon Dioxide Reduction	AF/MSC	AM/EXT
Secondary	S019	UV Stellar Astronomy	MSC	MDA
Secondary	S020	UV/X-ray Solar Photography	MSC	MDA
Secondary	M489	Heat Exchanger Service	MSC	MDA
Secondary	M493	Electron Beam Welding	MSFC	MDA
Secondary	M492	Tube Joining Assemblies	MSFC	MDA

5.3 Implementation: The following instructions are established for development, payload integration and mission planning activities associated with the above experiments:

a. Develop, integrate and include in operational mission planning all experiments assigned to AAP-1.

b. Develop all experiments assigned to AAP-2 within funding constraints.

c. The current objective is to integrate and operate as many of the experiments in AAP-2 as possible. Therefore, time line requirements and experiment support requirements (power, space, weight, cooling, etc.) will be reassessed and revised through a compatibility analysis to maximize the number of experiments that can be conducted. The relative priorities identified above are to be considered in this

effort. Secondary objective experiments that involve unique performance requirements that singularly complicate either integration or mission operations shall be re-examined to determine:

(1) Whether the unique requirements can be adequately relaxed, or
(2) Whether the experiment should be withdrawn from the mission.

Such recommendations should be transmitted to the Director, Apollo Applications for approval.

d. Future issues of this directive will reflect the results of the compatibility analysis identified in paragraph "c." above for the AAP-2 experiments.

6.0 SUPPORTING GROUND TEST CONSTRAINTS

Test program will be conducted in accordance with the Apollo Applications Test Requirements document (reference (d)) and appropriate test specifications. Mission Requirements documents prepared by the centers in support of these missions will identify by inclusion or reference the test constraints which must be lifted prior to mission execution.

6.1 Qualification: Components of the spacecraft, launch vehicles, nose cone, SLA, S-IVB/Airlock/Docking Adapter System, flight experiment hardware and associated support systems whose failure would jeopardize either crew safety (Category I) or the accomplishment of a primary mission objective (Category II) and which have not been flight tested will be ground qualified and/or certified prior to launch as described in Appendix D to reference (d). Basic Apollo hardware which has been flight tested (i.e., CSM) will be subjected to additional ground qualification and/or certification tests as required to provide confidence in meeting the long duration and other pertinent AAP requirements.

6.2 Launch Vehicles: The following flight stage tests will be performed on the AAP-1 and AAP-2 launch vehicles:

a. Manufacturing checkout of the IU's and S-IB and S-IVB flight stages.

b. Static test of the S-IB and S-IVB flight stages.

c. Post static checkout of the S-IB and S-IVB flight stages.

d. KSC inspection tests of the IU's and S-IB and S-IVB flight stages.

6.3 Nose Cone: The following ground tests will be performed:

a. Development and/or qualification tests.

b. Manufacturing checkout and acceptance tests.

c. KSC preflight checkout tests.

6.4 Airlock with Multiple Docking Adapter: The Airlock with Multiple Docking Adapter shall be fully qualified to support manned operations. In support of this requirement, the following ground tests will be performed:

a. Airlock:

(1) Development tests.
(2) Qualification and/or certification tests as required to meet AAP mission requirements.
(3) Systems tests.
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

b. MDA:

(1) Development tests.
(2) Qualification and/or certification tests as required to meet AAP mission requirements.
(3) Experiment payload integration tests.
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

c. Airlock/MDA: Integrated systems tests.

6.5 AAP-2 S-IVB: The AAP-2 S-IVB shall be fully qualified to support manned operations in earth orbit. In support of this requirement, the following ground tests will be performed:

a. Orbital Workshop Modifications: The stage as modified for powered flight with selected hardware for conversion to an Orbital Workshop pre-installed will require:

(1) Development tests.
(2) Manufacturing and acceptance tests.
(3) Qualification and/or certification tests as required to meet AAP mission requirements.
(4) Integrated systems tests.
(5) Static tests.
(6) Post static test checkout.
(7) KSC inspection tests.

b. Solar Array Modifications: The solar array system will require:

(1) Development tests.
(2) Qualification tests.
(3) Airlock/S-IVB systems integration tests.
(4) Manufacturing checkout and acceptance tests.
(5) KSC prelaunch tests.

c. Auxiliary Attitude Control System: The auxiliary control system will require:

(1) Development tests.
(2) Qualification tests.
(3) Integrated systems tests.
(4) Manufacturing and acceptance tests.
(5) KSC prelaunch tests.

6.6 AAP Experiments: The following ground tests will be performed:

a. Experiment development tests.

b. Qualification tests for each experiment.

c. Factory checkout and acceptance test of experiment and associated support systems.

d. Payload integration tests of experiment and associated support systems with carriers.

e. KSC prelaunch tests.

6.7 Spacecraft: The following major flight article ground tests will be performed on the AAP-1 CSM:

a. Qualification and/or certification tests on the basic Apollo CSM as required to meet the long duration and other pertinent AAP requirements.

b. Qualification tests for all AAP peculiar subsystems modifications to verify operation for the AAP-1/AAP-2 Mission.

c. Factory checkout and acceptance tests.

d. Integrated systems tests.

e. KSC prelaunch tests.

6.8 SLA: The following ground tests will be performed on the AAP-2 SLA as modified to meet mission requirements.

a. Development tests.

b. Qualification tests.

c. Manufacturing checkout and acceptance tests.

d. KSC preflight checkout tests.

6.9 Integrated Systems Tests: Integrated systems tests will be conducted to verify that flight hardware is physically, functionally and operationally compatible with associated ground support systems and mating hardware in the cluster configuration. Cluster configuration tests will be conducted with flight articles where practicable and with flight configured prototypes, simulators or master gauges, as appropriate, when the interfacing flight article cannot be made available. The following flight hardware interfaces will be verified:

a. Airlock - MDA

b. CSM (AAP-1, AAP-3, AAP-3A)- Airlock/MDA

c. S-IVB - Airlock

d. LM/ATM - MDA/Airlock

6.10 Prior Flight Missions: All launch vehicle, spacecraft and nose cone test anomalies resulting from all previous missions which could degrade or interfere with primary objectives will be fully evaluated and corrected prior to the launch of AAP-1 or AAP-2.

6.11 Design Certification Review (DCR): An AAP DCR will be conducted to certify all new hardware and all changes from the standard Apollo hardware required for this mission. Basic Apollo hardware already certified in previous DCR's will be recertified as required to meet AAP extended life and/or performance requirements. This review will also include certification of experiments likely to affect flight worthiness, manned flight safety and/or primary mission objectives. The DCR shall be in accordance with Apollo Program Directive No. 6A (reference (e)) as to be modified for AAP.

6.12 Certification: A Certification of Flight Worthiness (reference (d)) for each stage, SLA, nose cone, IU, spacecraft, Airlock/Docking Adapter and module (including the S-IVB LH_2 tank as an inhabited structure) is required prior to shipment from the factory and after static firing if appropriate. In addition, experiments whose failure would jeopardize crew safety (Category I) or the accomplishment of a primary mission objective (Category II) will also require preparation of a COFW. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 (reference (f)) as to be modified for AAP.

7.0 RELIABILITY AND QUALITY ASSURANCE

A Reliability and Quality Assurance Program will be conducted in accordance with the Reliability and Quality Assurance Plan (reference (g)) issued by AAP, R&QA, OMSF.

8.0 RESPONSIBILITIES

Center responsibilities for implementation of this mission are as follows:

8.1 MSFC:

a. Provide the Saturn IB launch vehicles and required vehicle and GSE modifications.

b. Develop the Orbital Workshop (Experiment M402) to include AAP-2 S-IVB solar array installation, AACS, stage modifications and kit preparation as required.

c. Develop assigned experiments and supporting hardware.

d. Integrate assigned experiments into the AAP-1 launch vehicle.

e. Integrate all experiments designated for transport in the AAP-2 flight.

f. Develop all launch vehicle telemetry and all signal conditioning equipment other than that associated with astronaut medical functions for the MDA/OWS.

g. Develop and integrate the nose cone with the AAP-2 payload.

h. Conduct guidance and control dynamics analyses for the ground launched space vehicle configuration and develop the requisite launch vehicle guidance and control capability.

i. Analyze the cluster maneuver dynamics for the AAP-1/AAP-2 Mission.

j. Conduct analyses in coordination with MSC in the areas of instrumentation and communications, electrical power distribution and expendables distribution for the space module cluster configuration as required for development of the Orbital Workshop (S-IVB spent stage) and the MDA.

k. Develop the MDA and associated GSE.

l. Provide launch vehicle performance constraints, systems data and guidance support to MSC for mission planning.

m. Provide technical support to MSC in support of their development of crew training procedures and flight operations planning for the Orbital Workshop, MDA and MSFC assigned/designated experiments.

n. Provide technical support to KSC as required during the acceptance, modification, prelaunch checkout and launch phases of this mission.

o. Provide test requirements which are suitable for KSC development of test procedures for MSFC end items.

p. Provide operational support to MSC as required during AAP-1/AAP-2 flight operations.

8.2 MSC:

a. Provide the CSM and associated GSE for the AAP-1 Mission.

b. Develop modification kits as required for the CSM to accomplish mission objectives.

c. Integrate experiments designated for transport in the AAP-1 CSM.

d. Develop the Airlock, associated GSE, and modification kits for the SLA to accomplish mission objectives.

e. Develop assigned experiments and supporting hardware.

f. Develop the signal conditioning equipment associated with astronaut medical functions, Airlock module telemetry and all AM/MDA/OWS transmitters operating after launch + 7 1/2 hours.

g. Conduct thermal balance analyses for the orbital assemblage.

h. Conduct analyses in coordination with MSFC in the areas of instrumentation and communications, electrical power distribution and expendables distribution for the space module cluster configuration as required for development of the Airlock and CSM.

i. Plan the mission to include mission design and develop the astronaut flight plan with appropriate inputs from MSFC for the Workshop, MDA and MSFC assigned experiments.

j. Plan and execute flight control, experiment and recovery operations.

k. Train the astronaut crew.

l. Provide test requirements which are suitable for KSC development of test procedures for MSC end items.

m. Provide technical support to KSC as required during the acceptance, modification, checkout, prelaunch and launch phases of this mission.

8.3 KSC:

a. Prepare checkout procedures and conduct prelaunch checkout of the launch vehicles with the associated GSE.

b. Prepare checkout procedures and conduct prelaunch checkout of the spacecraft and experiment hardware for AAP-1 with the associated GSE.

c. Install MSC and MSFC supplied kits and conduct modifications to Apollo hardware as required for execution at the launch site.

d. Prepare checkout procedures and conduct prelaunch checkout of the Airlock, MDA and experiment hardware for AAP-2 with the associated GSE.

e. Plan and execute space vehicle launch operations.

f. Provide technical support as required to MSC and MSFC concerning the KSC implementation of modifications to flight hardware and GSE hardware.

g. Prepare integrated space vehicle checkout procedures and conduct integrated checkout of the space vehicle with its associated ground support systems.

9.0 IMPLEMENTATION

MSC, MSFC and KSC shall develop Mission Requirements documents to implement the requirements stated herein. The MSC/MSFC requirements will be combined in a jointly signed-off directive.

Subsequent changes and future revisions to center Mission Requirements documents noted above which conflict with the requirements stated herein will require coordination between the centers and the review and approval of the Apollo Applications Director. Other revisions to the center Mission Requirements documents will be coordinated between centers as required with ten copies submitted to the Director, Apollo Applications, Code ML, for information.

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